MULTI-ACCESS SOLID STATE MEMORY DEVICES AND A TELEPHONE UTILIZING SUCH

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 12/233,618 of Moran et al., filed on Sep. 19, 2008, now U.S. Pat. No. 7,793,548 which is a divisional of U.S application Ser. No. 10/359,489, of Moran et al., now U.S. Patent No. 7,433,712, filed on Feb. 6, 2003.

FIELD OF THE INVENTION

The present invention is related to the field of non-volatile solid state memory devices, for example flash memory devices.

BACKGROUND

Mobile non-volatile solid state storage is available as a Disk-on-Keys™ system marketed by M-systems Inc. In this system, a small key fob with a USB connector includes a flash memory module and a controller which communicates over the USB connector with a host computer. The controller emulates a disk drive to the host system.

Many electronic devices use flash memory modules for non-volatile storage of data or code.

While many electronic devices store data (e.g., cellular telephones, organizers, palm computers), interfacing with a host computer typically requires special protocols and user interfaces.

There exist digital cameras that can be connected to a USB port on a host computer and images stored in their memory can be viewed on the host computer.

Some devices, while mobile, cannot be used at all times. For example, airlines prohibit the use of cellular telephones on airplanes, which blocks access to information stored on a cellular telephone, while the airline is in flight.

SUMMARY OF THE INVENTION

A broad aspect of some embodiments of the invention relates to packaging a flash memory storage system having its own directly accessible external interface, within the housing of a cellular telephone, so that an external device can directly access the storage system, as a storage system, using that connection. In an exemplary embodiment of the invention, the external interface allows a separate access directly to said storage system, as a storage system and not via a CPU of said telephone or another intermediary device. In an exemplary embodiment of the invention, the storage system is functionally integrated with the telephone. Alternatively or additionally, the storage system shares one or more hardware components with the telephone. It should be noted that even merely sharing a housing or other enclosure between a cellular telephone and a storage system may provide substantial benefits, for example, reducing weight, reducing clutter, preventing the storage system from being misplaced and/or reducing cost.

In an exemplary embodiment of the invention, the telephone provides added functionality to the storage system. For example, the telephone display and input may be used for managing the storage system. Alternatively or additionally, the telephone has access to and uses the storage system, for example, storing data on the storage system (which is also

accessible from outside the device) or transmitting or processing data stored on the storage system. Alternatively or additionally, the functionality of the telephone and storage system is at least partly integrated, for example, preventing the telephone from operating when the system is in use and/or preventing access of the telephone to the storage system when the storage system is otherwise occupied (e.g., connected to an external host). Alternatively or additionally, the storage system is used to support non-storage activities of the telephone, for example using its connector for telephone -related activities, for example printing.

In an exemplary embodiment of the invention, the directly accessible interface is a cable connection, such as using a USB connector. Alternatively or additionally, the interface is a sort range wireless connection, such as using IR or using a BlueTooth or other RF connection, such as IEEE 802.11.

Optionally, the software interface between a host computer and the telephone is stored on the telephone, possibly excepting a boot-strapping portion (e.g., a USB mass storage class driver and a USB stack) stored on the host computer.

In an exemplary embodiment of the invention, a random access block device interface (e.g., of a hard-disk) is used for attaching the telephone to a host computer. In an exemplary embodiment of the invention, this interface is used for accessing storage on the storage system alternatively or additionally to being used for interaction with the telephone. In one example, mail is transmitted using the cellular telephone by copying it from a host computer into a special file on the storage system. In some embodiments of the invention, the telephone accesses the storage system using a different protocol from the host computer.

In an exemplary embodiment of the invention, the storage system is functionally presented to the host as a stand-alone storage system, such as a Disk-On-Key™ system.

In an exemplary embodiment of the invention, separate controllers are provided for the storage system and the telephone. This might be useful, for example, to allow separate powering of the storage system when the telephone is powered off. Alternatively or additionally, the telephone controller provides at least some functionality for the storage system, for example controlling access and/or providing additional functionality, such as encryption.

An aspect of some embodiments of the invention relates to a partitioned flash memory storage system that is integrated with a telephone. In an exemplary embodiment of the invention, the partitioning, in software and/or hardware prevents deletion, writing and/or reading in at least part of the memory, from outside of the telephone. Alternatively or additionally, this partition is invisible from outside the telephone. For example, an operating system of the telephone may be stored in a shared memory system and be partitioned so that direct access to the storage system, not through the telephone, cannot be used to modify the operating system by a user. Optionally, the operating system (or other important code and/or data) is also protected from erasure, optionally by a method other than partitioning or the access to it is enabled only by password.

In an exemplary embodiment of the invention, the flash memory is partitioned into several parts, two or more of: a partition private to the storage system, from external access, a partition private to the telephone, and a partition with hidden data, for example code for operating the flash memory system and/or the telephone.

An aspect of some embodiments of the invention relates to a dual mode flash memory controller on a single integrated circuit which can be controlled and/or powered in two or more different ways. In an exemplary embodiment of the